INTELLIGENT TRANSPORTATION SYSTEMS INSTITUTE
SENSOR
A periodic publication from the Intelligent Transportation Systems (ITS) Institute
2005 Volume 6, Issue 1

Technological assistance aims to reduce dangerous driving by teens

The tragedy of young, inexperienced drivers losing their lives behind the wheel resonates through families and communities every day. Despite making up less than five percent of licensed drivers, teens account for more than 13 percent of all passenger vehicle fatalities. But once kids leave the driveway, it seems there is little that can be done to regulate their behavior behind the wheel. Or is there?

Recently, new in-vehicle technologies have emerged, aimed at curbing dangerous behaviors such as speeding, driving while intoxicated, and failing to use seat belts. Some of these technologies are commercially available, while others are under development at the University of Minnesota.

With support from the ITS Institute, mechanical engineering graduate student Shawn Brovold is developing an in-vehicle "black box" called the Teen Driver Support System (TDSS) that could help curb unsafe teen driving behavior. Brovold is collaborating with Intelligent Vehicles (IV) Laboratory director Craig Shankwitz, as well as with human factors researchers in the University's HumanFIRST Program.

The project will integrate emerging technologies based on determination of vehicle location and road geometry via the integration of Global Positioning System data and geospatial databases with currently available technologies, including onboard data logging and, optionally, in-vehicle systems to detect alcohol use.

Teen drivers, according to U of M Law School professor Stephen Simon, are a good target for programs of this type because parents are able and willing to help ensure safe driving behavior. Simon, founder and director of the Minnesota Criminal Justice System DWI Task Force, has contributed expertise in traffic safety and legal issues to the project.

Teen drivers experience much higher accident rates than other age groups, due to inexperience and unsafe driving behaviors.
(Photo credit: AAA Foundation for Traffic Safety)

Beyond the sphere of parental enforcement, such a monitoring system could potentially be integrated with graduated licensing procedures for beginning drivers.

The system under development will take a three-tiered approach to reducing unsafe teen driving behavior:

- Seat-belt/ignition interlocks and alcohol breath-testing can prevent operation of the vehicle;
- Detection of excessive speed or other unsafe operation can provide feedback during vehicle operation;
- Incidents of speeding or unsafe operation can also be logged for later analysis by parents or licensing officials.

Proactive support for inexperienced drivers

Among the most powerful aspects of the system under development is the capability to correlate a vehicle's speed with its location. Similar devices have been tested extensively in Europe, but Brovald's group is the first to evaluate this technique in the United States, and the first to apply it specifically to teen drivers. Systems which simply monitor and log vehicle speed are of limited use in this context, because local speed limits and road geometries are not known. The combination of speed and location will enable the prototype system to respond to unsafe driving or violations of local speed limits.

The ITS Institute's Intelligent Vehicles Laboratory has previously developed onboard systems that use high-accuracy GPS and digital mapping to compute vehicle locations in real time—technology that is central to the SAFEPLOW technology-enhanced snowplow and the TechnoBus transit research vehicle.

Teens *continued*

2004 Student of the Year contributes to vision-based traffic monitoring

2004 Student of the Year Nathaniel Bird receives the award from ITS Institute director Dr. Max Donath

The 2004 ITS Institute Outstanding Student of the Year award was presented to Nathaniel Bird. Bird is a Master of Science in Computer Science candidate at the University of Minnesota. He received his Bachelor of Science in Computer Engineering with high honors from Ohio Northern University, and is a registered Engineer in Training in the State of Ohio.

Bird has been a key asset to one of the Institute's high-profile research topics: Monitoring Human Activities at Bus Stops, led by Computer Science professor Nikos Papanikolopoulos. Bird is currently working on developing automated intelligent vision-based traffic monitoring systems that can aide a human user in the process of risk detection and analysis. His work was applied to the problem of detecting drug-related activities at bus stops and received great reviews from the community.

Bird has shown excellence in the classroom by earning a 4.0 GPA as a graduate student. He has been involved in numerous honor societies, including the Tau Beta Pi Engineering Honor Society and the Sigma Pi Sigma Physics Honor Society. His classroom success has not only been recognized by being on the Dean's List at Ohio Northern University for each of his 12 semesters, but also by being awarded scholarships such as the Robert C. Byrd Scholarship from the Ohio Board of Regents and a University of Minnesota Computer Science fellowship.

Bird also has an extensive list of publications, and a nomination for the best ICRA 2004 Vision Paper Award. He has been an author for multiple other journals and conference papers. His current advisor describes Nate as "very well-organized and able to view a problem from several different perspectives without any difficulties."

Safety implications of ATIS use with cell phones

Study shows cell phones may impair drivers more than being drunk

Using a cell phone may impair drivers more than alcohol intoxication, according to a new study by University researchers.

Nic Ward, director of the University's HumanFIRST Program (www.its.umn.edu/labs/humanfirst.html) and principal investigator for the project, described his findings in February during a CTS Transportation Safety and Traffic Flow Council meeting. The presentation, titled "Design and Safety Implications for ATIS Use with Cell Phones," was part of the CTS Research Seminar Series for students, faculty, and practitioners (www.cts.umn.edu/education/seminars) about transportation research at the University of Minnesota.

"The drunk driver doing nothing was less impaired than the same person on a cell phone or playing with the radio," Ward said, describing details of the study. Researchers gathered data from test subjects outfitted with a device to measure brain activity and using the Virtual Environment for Surface Transportation Research (VESTR) driving simulator in the HumanFIRST lab. Half of the test subjects drank vodka with cranberry juice to near intoxicating levels (just under .08 blood-alcohol content) as measured with a Breathalyzer.

Because evidence suggests that cell-phone use while driving may be a significant risk factor in traffic crashes, some states have responded by imposing restrictions on the use of hand-held phones. But Ward's research team, citing research that shows hands-free use is no safer than hand-held, has focused instead on the cognitive aspect of talking on a cell phone while driving. "It's actually the conversational component of operating a cell phone while driving that is the culprit," Ward said, "not just the physical manipulation of the phone."

Inappropriate cell phone use by drivers can be as dangerous as intoxication, new research suggests.

In particular, the two-part study is probing the risks of using cell phones to access new advanced traveler-information systems (ATIS) recently introduced in many states (e.g., 511 Traveler Information Services). Phase I of the study examined how the performance impairment from cell-phone use compares to other types of impairment risks, such as driving while intoxicated (.08 blood-alcohol content) and while operating common in-vehicle controls like a radio, fan, or air conditioning. For the first time, researchers also examined the combined effects of being distracted and being intoxicated, given that many crashes result from a combination of risk factors. Phase II will look at how impairment from 511 interactions compares to other types of cell-phone use, such as conversation.

Ward explained that use of a cell phone and other typical in-vehicle tasks are considered secondary to the primary tasks of driving and driving safely. Previous studies have shown that the increased mental demand of cell-phone use causes impairment—and an increased crash risk. By Ward's definition, impairment means exceeding the limit of one's ability to apply the necessary resources toward a particular task. When that task is driving, impairment may, for example, cause speed inconsistency and slower reaction toward unexpected events. "The brain is dulled because of the secondary task," Ward said.

In measuring driver distraction, Ward drew a distinction between episodic and continuous driving tasks and their effects—when combined with secondary tasks—on a driver's "workload" and ability to drive safely. Continuous driving tasks, he said, make it easier to see impairments in driving due to secondary tasks. Specifically, hands-free cell-phone conversations demonstrated significant impairment. But in-vehicle tasks consistently showed the most impairment because they combine both cognitive and physical distraction.

"Banning cell phones isn't the solution," he concluded. "It's the appropriate use of cell phones."

The cell-phone use study also included the work of HumanFIRST research scientist Mick Rakauskas, along with Ed Bernat, Meredith Cadwallader, and Professor Chris Patrick of the psychology department. The research was sponsored by Minnesota Guidestar and the ITS Institute.

More information about this research may be found online at www.cts.umn.edu/research/projectdetail.pl?id=2003040.

—Michael McCarthy

Teens *from front*

Building on this experience, the system currently under development uses an onboard computer, based on the compact PC104 platform commonly used for embedded applications, to integrate speed and location data, determined by a GPS system. Speed and location can then be correlated with information about the road on which the vehicle is being operated, such as local speed limits and road geometry, contained in digital maps and databases. Future enhancements to the system may include the ability for the TDSS to interface directly with a vehicle's onboard diagnostic system to collect data such as vehicle speed.

This location awareness makes it possible for the system to not only look at current conditions, but to proactively look "down the road" and evaluate sudden curves or other changes in road geometry—a common cause of run-off-the-road crashes by inexperienced drivers, especially in rural areas. When the system determines that the vehicle speed is too great to safely negotiate an upcoming curve, intersection, or other road feature, it will be able to proactively warn the driver and/or log the incident.

Combining different technologies to create a single integrated system that supports driver capabilities is characteristic of many ITS Institute research projects, says Institute director Max Donath. A significant portion of the Institute's recent work has involved combining new and existing technologies to address specific safety and mobility issues.

—Peter Nelson

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A periodic publication from the Intelligent Transportation Systems (ITS) Institute

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